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(54) **Method of selecting devices for use in fluid pipeline network**

Verfahren zur Selektion von Geräten im Fluidrohrleitungsnetz

Méthode de sélection de dispositif dans un réseau de tuyauterie de fluide

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Description**BACKGROUND OF THE INVENTION**

5 **[0001]** The present invention relates to a method of selecting devices for use in a fluid pipeline network, e.g. a pneumatic pipeline network or a coolant pipeline network, for supplying compressed air, cooling water, etc. to various machining devices or the like.

10 **[0002]** To select pipes, pipe joints and valves (stop valves) for use in a fluid pipeline network, first, a block diagram of the fluid pipeline network is made. In the block diagram, user-specified data items, such as the length of each section, the pressure and flow rate at a fluid source, and the flow rate at each of inlet and outlet portions, are entered. The designer temporarily selects sizes of pipes, pipe joints and valves by intuition. Then, the designer forms equations representing the flow rate at each branch point (junction point) in the fluid pipeline network and also forms equations representing the pressure and flow rate in each section. These equations are solved as simultaneous equations to obtain a pressure drop and flow rate in each section of the fluid pipeline network, and differences between the user's desired values and the calculated values are obtained. In view of the differences, the sizes of the devices are changed, and a calculation similar to the above is performed. The calculation and the change in size of the devices are repeated to select devices that meet the user's demand. The above-described selection method is described in "The Energy Conservation" Vol. 50, No. 3, pp. 81-84, published in March, 1998, by The Energy Conservation Center Japan.

20 **[0003]** According to the conventional technique, a block diagram of a fluid pipeline network is drawn on a sheet of paper, and input conditions are entered in the block diagram. Devices to be used are temporarily selected, and a pressure drop and flow rate in the fluid pipeline network are calculated by an appropriate method. The temporary selection of devices and the calculation are repeated many times until the calculated pressure drop and flow rate reach the desired values. Therefore, much labor is required to select optimum devices.

25 **[0004]** EP 0 626 652 A1 discloses a method and apparatus for determining elementary circuits and initial values of flows in a pipe network. This pipe network comprises source nodes and demanding nodes connected by pipes having particular pipe resistances. Those pipe resistances are given in advance. The resistance of a passage from each source node to each one of the demanding nodes is calculated on the basis of the resistances of said pipes. By this method, an apparatus, elementary circuits, and initial values of flows in a pipeline network are automatically determined.

Summary of the Invention

30 **[0005]** An object of the present invention is to provide a method of selecting devices for use in a fluid pipeline network, according to which allowable conditions are met with easy device selection by allowing change of selection of devices and/or parameters of the network.

35 **[0006]** According to the present invention, node positions and branch positions, which are arranged in a grid pattern, can be displayed on a screen, and inlet portions, branch points and outlet portions are selected from the node positions. Further, sections to which section devices are to be connected are selected from the branch positions and the node positions to make a circuit configuration.

40 **[0007]** As a result of the computation using the node analysis method, a pressure is displayed at each branch point, and a pressure and a flow rate are displayed at each of the inlet and outlet portions.

45 **[0008]** According to the present invention, after the entry of the value of allowable pressure loss, the pressure at each inlet portion and the flow rate at each of the inlet and outlet portions, all sections of the fluid pipeline network are subjected to computation using the node analysis method to judge whether or not there is a section that does not satisfy the condition of allowable pressure loss. If there is such a sections, an inlet / outlet flow rate change or a section device change is made with respect to the section. Then, a judgement as to whether or not there is a section that does not satisfy the condition of allowable pressure loss is made again by computation using the node analysis method. The inlet / outlet flow rate change or the section device change and the computation are repeated until there is no section that does not satisfy the condition of allowable pressure loss.

50 **[0009]** As a result of the computation using the node analysis method, a pressure is displayed at each branch point, and a pressure and a flow rate are displayed at each of the inlet and outlet portions.

55 **[0010]** Items of data concerning devices are stored in the pipe database, the pipe joint database, and the valve database, and calculating equations for use in computation are also stored. Devices are temporarily selected by using the stored device data, and then computation is performed by using the stored calculating equations. Therefore, device selection can be made easily. In addition, node positions and branch positions are displayed on a screen. Inlet portions and outlet portions are selected from the node positions, and pipeline sections are selected from the branch positions and the node positions. Therefore, a block diagram of the fluid pipeline network can be made easily.

[0011] The inlet / outlet flow rate change or the section device change and the computation using the node analysis method are repeated until there is no section that does not satisfy the condition of allowable pressure loss. Therefore,

selection of devices desired by the user can be made accurately. Further, as a result of the computation, a pressure is displayed at each branch point on the screen, and a pressure and a flow rate are displayed at each of the inlet and outlet portions. Therefore, the computational results can be grasped easily.

[0012] The present invention is applied to a method of selecting devices for use in a fluid pipeline network, wherein a circuit configuration of the fluid pipeline network is made by connecting together sections between a fluid source, inlet portions, branch points and outlet portions with section devices, and a pressure at the fluid source and a flow rate at each outlet portion are given. Then, the pressure loss in each section between the fluid source and an inlet or outlet portion is adjusted to the desired value of allowable pressure loss. According to the present invention, items of data concerning devices (pipes, pipe joints and valves) are stored in databases for the various devices, and calculating equations for use in computation are also stored. Section devices are selected from the databases for the various devices, and pressures at branch points and outlet portions are computed with respect to the fluid pipeline network for which the section devices have been selected, by using the stored calculating equations.

[0013] Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

[0014] The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a flowchart showing the flow of an embodiment of the method of selecting devices for use in a fluid pipeline network according to the present invention.

Fig. 2 is a flowchart showing the flow of computation (node analysis method) at step S7 in Fig. 1.

Fig. 3 shows a screen of a personal computer used in the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Figs. 1 to 3 show an embodiment of the method of selecting devices for use in a fluid pipeline network according to the present invention. Fig. 1 is a flowchart showing the flow of the embodiment of the present invention. The steps are defined as follows:

- S1: Initialization
- S2: Enter allowable pressure loss
- S3: Enter circuit configuration
- S4: Enter section devices
- S5: Enter fluid source pressure
- S6: Enter inlet/outlet flow rate
- S7: Computation (node analysis method)
- S8: Output computational results
- S9: Print out and magnetically store results
- S10: Change for better
- S11: Display section between fluid source and inlet/outlet portion that does not satisfy allowable pressure loss
- S12: Object to be changed for better?
- S13: Enter inlet/outlet flow rate
- S14: Enter section device
- S15: Change status quo
- S16: Terminate.

Fig. 2 is a flowchart showing the flow of computation (node analysis method) at step S7 in Fig. 1. These steps are defined as follows:

- S7-1: Make input-output matrix from entered circuit configuration
- S7-2: Read physical data required to calculate branch diameter & length and admittance
- S7-3: Make input-output matrix from entered circuit configuration
- S7-4: Set initial values branch flow rate and mean pressure for each branch
- S7-5: Calculate admittance

- S7-6: Calculate node admittance matrix
 S7-7: Solve simultaneous equations to obtain unknown node pressure and flow rate
 S7-8: Calculate flow rate at each branch from node pressure
 S7-9: Is difference between calculated branch flow rate and given branch flow rate less than convergence criterion value
 S7-10: Newly set branch flow rate and mean pressure for each branch.

Databases for various devices include a pipe database, a pipe joint database and a valve database, in which items of data concerning devices to be selected, i.e. pipes, pipe joints and valves (stop valves), have been stored in advance. Regarding pipes and valves, items of data such as ID numbers, names, inner diameters and pipe friction factors are stored. Regarding pipe joints, data items such as ID numbers, names, pipe connection ID numbers and straight pipe-equivalent lengths are stored. Fig. 3 shows a screen of a personal computer. While looking at the screen, the operator selects devices according to the flows shown in Figs. 1 and 2.

[0017] In the embodiment of the present invention, input conditions given by the user are a circuit configuration, lengths of sections, pipe diameters, flow rates at inlet and outlet portions, and a pressure and flow rate at a fluid source. A desired value given by the user is a value of allowable pressure loss in each section between the fluid source and an inlet or outlet portion.

[0018] When the program of the flowchart shown in Fig. 1 is started, initialization is executed at step S1. By the initialization, the program (including calculating equations for use in computation) is read, and display of an input screen, connection with the databases for the various devices, etc. are executed. On the screen shown in Fig. 3, immediately after the initialization, node positions arranged in a grid pattern are shown by white squares, and branch positions between the node positions are shown by double lines. At step S2, a user-specified desired value of allowable pressure loss in each section between the fluid source and an inlet or outlet portion is entered.

[0019] At step S3, a circuit configuration of the fluid pipeline network is entered. To enter the circuit configuration, branch positions, which are shown by the double lines in Fig. 3, are sequentially selected and clicked (when clicked, the double lines become black thick lines). Inlet and outlet portions are selected from terminal portions of the circuit (when determined to be an inlet or outlet portion, a node position shown by a white square at a terminal portion changes to a black square). A circuit configuration is made by selection of inlet portions, branch points and outlet portions from the node positions and selection of sections to which section devices are to be connected from the branch and node positions. It should be noted that branch pipes are used at branch points, and series pipes and pipe joints are used at node positions that form intermediate portions of sections. In this embodiment, the position of a fluid source is designated next to the upper left-end node position on the left.

[0020] The sections between the inlet portions, branch points and outlet portions selected at step S3 are displayed as branches between the nodes that are shown by black thick lines. The length of each section is the sum of the length of pipe, the lengths of pipe joints (including node pipe joints) and the straight pipe-equivalent lengths of valves. At step S4, the length of pipe, the number of pipe joints and the number of valves are entered, and the diameter of pipe, the type of pipe joint and the type of valve are entered by being selected from the databases for the various devices. It should be noted that the diameter and length of pipe and the types and numbers of pipe joints and valves are temporarily selected by taking into account the user's desired input conditions. At step S5, the value of supply pressure of the fluid source is entered (in a pneumatic pipeline network, the fluid source pressure is generally 0.4 to 0.8 MPa; in a coolant pipeline network, it is generally 0.05 to 2 MPa).

[0021] In the case of general fluid pipeline networks other than coolant pipeline networks, e.g. in a pneumatic pipeline network, the flow rate value at each of the inlet and outlet portions (black squares) is entered at step S6. In the case of a coolant pipeline network, the nozzle diameter, the number of nozzles and the opening pressure are entered in place of the flow rate value at each outlet portion on the assumption that a coolant (cooling water) is jetted out from nozzles at the outlet portion. At step S7, a flow rate value is calculated from the nozzle diameter, the number of nozzles and the opening pressure. With this flow rate value, the process is carried out in the same way as in a case where the flow rate value at the outlet portion was entered at step S6.

[0022] At step S7 in the flowchart shown in Fig. 1, the pressure at each node of the fluid pipeline network is obtained by the node analysis method on the basis of the entered parameters. The computation using the node analysis method is performed according to the flowchart of Fig. 2. The following node analysis method is used:

$$Q_L = A \cdot Q \quad \text{-----} \quad (1)$$

$$Q = Y \cdot A^T \cdot P \text{ ----- (2)}$$

$$Q_L = A \cdot Y \cdot A^T \cdot P = Y_N \cdot P \text{ ----- (3)}$$

$$Y_N = A \cdot Y \cdot A^T \text{ ----- (4)}$$

$$Q = Y(P_1 - P_2) \text{ ----- (5)}$$

$$Y = \pi^2 D^{5.31} P / 8 f L \rho P_0 Q \text{ ----- (6)}$$

$$Y = 1 / \{ f(L/D^5)(8/\pi^2 g) \rho g Q \} \text{ ----- (7)}$$

where

Q:FLOW RATE

SUPERSCRIPT T:TRANSPOSITION SYMBOL

P:PRESSURE

(*P*₀:ATMOSPHERIC PRESSURE)

Y:ADMITTANCE

K:FLOW COEFFICIENT

D:PIPE INNER DIAMETER

L:PIPE LENGTH

S:SPECIFIC GRAVITY

B:SOUND VELOCITY

f:PIPE FRICTION FACTOR

g:GRAVITATIONAL ACCELERATION

ρ :DENSITY

Q_L:NODE FLOW LOAD VECTOR

Q:BRANCH FLOW VECTOR

A:INPUT-OUTPUT MATRIX.

These equations are stored in advance. It should be noted that equation (3) is derived from equations (1) and (2). Equation (6) represents the admittance of the pipeline in a case where a gas is used as a fluid. Equation (7) represents the admittance of the pipeline in a case where a liquid is used as a fluid.

[0023] At step S7-1 in Fig. 2, an input-output matrix [*A* in equation (1)] is made from the entered circuit configuration. It should be noted that, in the input-output matrix, branches and nodes are arranged in rows and columns, respectively, to show whether or not there is a flow at a branch or a node and to indicate the direction of the flow. At step S7-2, physical data required to calculate the branch diameter and length and the admittance of the fluid pipeline network is read. For the branch diameter, data is selected and read from the pipe database. For the branch length, the user-specified section length is read. The density (varying in value according to the kind of fluid) and the gravitational acceleration are prepared in the program in advance.

[0024] At step S7-3, an input-output matrix is made from the entered circuit configuration. At step S7-4, initial values of the branch flow rate and mean pressure are set for each branch. It should be noted that the initial value of branch flow rate is an appropriate numerical value other than zero, and the mean pressure (the maximum pressure in the circuit)

is also an appropriate numerical value (in a pneumatic pipeline network, 1 m³/min (ANR) is used as the branch flow rate, and the pneumatic source pressure (MPa) is used as the mean pressure).

[0025] At step S7-5, admittance is calculated. In a case where a gas is used as a fluid (e.g. a pneumatic pipeline network), admittance is calculated by using equation (6). In a case where a liquid is used as a fluid (e.g. a coolant pipeline network), admittance is calculated by using equation (7). At step S7-6, the node admittance matrix is calculated by using equation (4). At step S7-7, the simultaneous equations (3) are solved to obtain an unknown node pressure and flow rate. It should be noted that the Gaussian elimination previously incorporated in the program is used for this calculation.

[0026] At step S7-8, the flow rate at each branch is calculated from the pressure at each node by using equation (5) in Fig. 4. At step S7-9, it is judged whether or not the difference between the branch flow rate obtained by the calculation at step S7-8 and the branch flow rate initially given at step S7-4 is less than a predetermined value of convergence criterion. If YES is the answer at step S7-9, the process proceeds to step S8 in Fig. 1.

[0027] If it is judged at step S7-9 that the difference between the calculated branch flow rate and the initially given branch flow rate is not less than the value of convergence criterion, a branch flow rate and mean pressure are newly set for each branch at step S7-10. Then, the process proceeds to step S7-5, and the flow of steps S7-5 to S7-9 is repeated. It should be noted that the mean pressure set at step S7-10 is obtained by calculating a mean value at each branch from the node pressure obtained by solving the simultaneous equations.

[0028] At step S8 in Fig. 1, the results of the computation are outputted. In the screen shown in Fig. 3, for example, the pressure at each branch point in the circuit configuration of the fluid pipeline network is displayed on the lower right of the node position representing the branch point, and the pressure and flow rate at each of the inlet and outlet portions are displayed on the lower right of the node position representing the inlet or outlet portion (the pressure being displayed in the upper place, and the flow rate in the lower place). At step S9, the computational results are printed out and also stored on a hard disk (a magnetic recording medium used with the personal computer), a floppy disk (a magnetic recording medium), an MO (a magneto-optic disk), etc.

[0029] At step S10, whether or not to make a change for the better is judged. The judgment as to whether or not to make a change for the better is made on the basis of the above-described value of allowable pressure loss. If there is a section that does not satisfy the condition of allowable pressure loss among the sections between the fluid source and the inlet or outlet portions in the fluid pipeline network, it is judged that a change for the better should be made. The operator makes the judgment at step S10 while looking at the screen shown in Fig. 3. If it is judged at step S10 that a change for the better should not be made, the process proceeds to step S15.

[0030] If it is judged at step S10 that a change for the better should be made, a section that does not satisfy the condition of allowable pressure loss among the sections between the fluid source and the inlet or outlet portions in the fluid pipeline network is displayed at step S11. At step S12, an object to be changed for the better, i.e. either an inlet/outlet flow rate change or a section device change, is chosen with regard to the section not satisfying the condition of allowable pressure loss. Regarding the choice at step S12, if the operator judges that the user-specified conditions will be satisfied if the inlet/outlet flow rate at the present stage is changed, the inlet/outlet flow rate change is chosen. If the operator judges that the section devices should preferably be changed, the section device change is chosen.

[0031] If the inlet/outlet flow rate change is chosen at step S12, the process proceeds to step S13, at which, in the case of a fluid pipeline network (e.g. a pneumatic pipeline network) other than coolant pipeline networks, a changed value of the flow rate at the inlet or outlet portion as a terminal portion is entered. Then, the process proceeds to step S7. In the case of a coolant pipeline network, changed values of the nozzle diameter, the number of nozzles and the opening pressure are entered in place of the flow rate value (the flow executed thereafter is the same as in the case of step S5). If the section device change is chosen at step S12, the process proceeds to step S14, at which changed data items concerning the pipe diameter and length and the types and numbers of pipe joints and valves are entered by being selected from the databases for the various devices. Then, the process proceeds to step S7. The flow from step S7 to step S10 is executed in the same way as in the previous process. The flow from step S10 through steps S11 and S7 to step S10 is repeated until it is judged at step S10 that a change for the better should not be made.

[0032] If it is judged at step S10 that a change for the better should not be made, whether or not to change the status quo is judged at step S15. If there is no mistake such as a data entry mistake, it is judged that the status quo should not be changed, and the process proceeds to step S16. If it is noticed that there is a data entry mistake or the like, or if it is necessary to read computational results stored on a magnetic recording medium in a previous selection of devices and to change a part of the read results, it is judged at step S15 that the status quo should be changed, and the process returns to step S3.

[0033] At step S16, whether or not to terminate the program is judged. If it is judged that the program should be terminated, the process proceeds to "End". If it is desired to make a device selection for another fluid pipeline network, it is judged at step S16 that the program should not be terminated, and the process returns to step S1. By initialization at step S1, the information used for the previous device selection is cleared, and the display of the screen shown in Fig. 3 is also cleared.

[0034] Although in the foregoing embodiment of the present invention the position of a fluid source is designated next

to the upper left-end node position on the left in the circuit configuration shown in Fig. 3, the arrangement may be such that a fluid source is connected to an inlet portion as a terminal portion of the circuit and this inlet portion is regarded as a fluid source. In this case, the inlet portion also serves as a fluid source, and the pressure at the inlet portion is entered as the fluid source pressure at step S5. Further, the desired value given by the user in this case is a value of allowable pressure loss in each section between the inlet portion and an outlet portion.

Claims

1. A method of selecting devices for use in a fluid pipeline network, wherein a circuit configuration of the fluid pipeline network is made by connecting together sections between a fluid source, inlet portions, branch points and outlet portions with section devices, and a pressure at the fluid source and a flow rate at each outlet portion are given, and then a pressure loss in each section between the fluid source and an inlet or outlet portion is adjusted to a desired value of allowable pressure loss, said method comprising the steps of:

- i) entering a desired value of allowable pressure loss (S2) in each section between the fluid source and an inlet or outlet portion;
- ii) selecting inlet portions, branch points and outlet portions (S3) from the node positions, and further selecting sections (S4) to which section devices are to be connected from the branch positions and the node positions to make a circuit configuration of a fluid pipeline network;
- iii) selecting section devices (S4), i.e., pipes, pipe joints, and valves from a pipe database, a pipe joint database, and a valve database, respectively;
- iv) computing pressures (S7) at the branch points and the outlet portions in respect to the fluid pipeline network for which the section devices have been selected, by using stored calculating equations based on the node analysis method;
- v) computing (S7), using the node analysis method, pressures at the branch points and pressure and the flow rate at each of the inlet and outlet portions and displaying same (S8) as a result of the computation;
- vi) judging whether or not there is a section that does not satisfy a condition of allowable pressure loss (S10, S11) for all sections of the fluid pipeline network that have been subjected to the computation using the node analysis method;
- vii) changing inlet / outlet flow rate or a section device (S13, S14) with respect to the section that does not satisfy the condition of allowable pressure loss;
- viii) computing the pressures at the branch points and the outlet portions with respect to the fluid pipeline network again by using the node analysis method (S7);
- ix) judging whether or not there is a section that does not satisfy the condition of allowable pressure loss again (S10), and
- x) repeating the inlet / outlet flow rate change or the section device change (S13, S14) and the computation (S7) until there is no section (S10, S15, S16) that does not satisfy the condition of allowable pressure loss.

2. The method according to claim 1, wherein node positions and branch positions between the node positions are displayed in a grid pattern on a screen of a particular personal computer.

Patentansprüche

1. Verfahren zum Auswählen von Vorrichtungen zum Einsatz in einem Fluid-Rohrleitungsnetz, wobei eine Kreislaufkonfiguration des Fluid-Rohrleitungsnetzes hergestellt wird, indem Abschnitte zwischen einer Fluidquelle, Einlassbereiche, Verzweigungspunkte und Auslassbereiche mit Abschnittsvorrichtungen verbunden werden und ein Druck an der Fluidquelle sowie eine Strömungsgeschwindigkeit an jedem Auslassbereich vorgegeben werden und dann ein Druckverlust in jedem Abschnitt zwischen der Fluidquelle und einem Einlass- oder Auslassbereich auf einen gewünschten Wert eines zulässigen Druckverlustes reguliert wird und das Verfahren die folgenden Schritte umfasst:

- I) Eingeben eines gewünschten Wertes eines zulässigen Druckverlustes (S2) in jedem Abschnitt zwischen der Fluidquelle und einem Einlass- oder Auslassbereich;
- II) Auswählen von Einlassbereichen, Verzweigungspunkten und Auslassbereichen (S3) aus den Knotenpositionen und des Weiteren Auswählen von Abschnitten (S4), mit denen Abschnittsvorrichtungen von den Verzweigungspositionen und den Knotenpositionen verbunden werden sollen, um eine Kreislaufkonfiguration eines Fluid-Rohrleitungsnetzes herzustellen;

III) Auswählen von Abschnittsvorrichtungen (S4), d.h. Rohren, Rohrverbindungen und Ventilen, aus einer Rohr-Datenbank, einer Rohrverbindungs-Datenbank bzw. einer Ventil-Datenbank;

IV) Berechnen von Drücken (S7) an den Verzweigungspunkten und den Auslassbereichen in Bezug auf das Fluid-Rohrleitungsnetz, für das die Abschnittsvorrichtungen ausgewählt worden sind, unter Verwendung gespeicherter Berechnungsgleichungen auf Basis des Knotenanalyseverfahrens;

V) Berechnen (S7) von Drücken an den Verzweigungspunkten sowie Druck und der Strömungsgeschwindigkeit an jedem der Einlass- und Auslassbereiche unter Verwendung des Knotenanalyseverfahrens und Anzeigen derselben (S8) als ein Ergebnis der Berechnung;

VI) für alle Abschnitte des Fluid-Rohrleitungsnetzes, die der Berechnung unter Verwendung des Knotenanalyseverfahrens unterzogen wurden, Feststellen, ob ein Abschnitt vorhanden ist, der eine Bedingung eines zulässigen Druckverlustes nicht erfüllt, oder nicht (S10, S11);

VII) Ändern der Einlass/Auslass-Strömungsgeschwindigkeit oder einer Abschnittsvorrichtung (S13, S14) in Bezug auf den Abschnitt, der die Bedingung eines zulässigen Druckverlustes nicht erfüllt;

VIII) erneutes Berechnen der Drücke an den Verzweigungspunkten und den Auslassbereichen in Bezug auf das Fluid-Rohrleitungsnetz unter Verwendung des Knotenanalyseverfahrens (S7);

IX) erneutes Feststellen, ob ein Abschnitt vorhanden ist, der die Bedingung eines zulässigen Druckverlustes nicht erfüllt, oder nicht (S10), und

X) Wiederholen der Änderung der Einlass/Auslass-Strömungsgeschwindigkeit oder der Änderung der Abschnittsvorrichtung (S13, S14) und der Berechnung (S7), bis kein Abschnitt vorhanden ist (S10, S15, S16), der die Bedingung eines zulässigen Druckverlustes nicht erfüllt.

2. Verfahren nach Anspruch 1, wobei Knotenpositionen und Verzweigungspositionen zwischen den Knotenpositionen in einem Gittermuster auf einem Bildschirm eines bestimmten Personal-Computers angezeigt werden.

Revendications

1. Procédé pour sélectionner des dispositifs destinés à être utilisés dans un réseau de conduites de fluide, dans lequel une configuration de circuit du réseau de conduites de fluide est réalisée en raccordant ensemble des sections entre une source de fluide, des parties d'entrée, des points de branchement et des parties de sortie à des dispositifs de section, et une pression à la source de fluide et un débit à chaque partie de sortie sont donnés, puis une perte de pression dans chaque section entre la source de fluide et une partie d'entrée ou de sortie est ajustée à une valeur souhaitée d'une perte de pression admissible, ledit procédé comprenant les étapes consistant :

i) d'entrée d'une valeur souhaitée d'une perte de pression admissible (S2) dans chaque section entre la source de fluide et une partie d'entrée ou de sortie ;

ii) de sélection des parties d'entrée, des points de branchement et des parties de sortie (S3) à partir des positions de noeuds, et de sélection, en outre, des sections (S4) auxquelles des dispositifs de sections sont à raccorder à partir des positions de branchement et des positions de noeuds afin de réaliser une configuration de circuit d'un réseau de conduites de fluide ;

iii) de sélection des dispositifs de sections (S4), c'est-à-dire, des conduites, des raccords de conduite et des vannes, à partir d'une base de données de conduites, d'une base de données de raccords de conduites et d'une base de données de vannes, respectivement ;

iv) de calcul des pressions (S7) aux points de branchement et aux parties de sortie eu égard au réseau de conduites de fluide pour lequel les dispositifs de sections ont été sélectionnés, en utilisant des équations de calcul mémorisées qui sont basées sur la méthode d'analyse des noeuds ;

v) de calcul (S7), en utilisant la méthode d'analyse des noeuds, des pressions aux points de branchement et de la pression et du débit à chacune des parties d'entrée et de sortie, et d'affichage (S8) de celles-ci en tant que résultat du calcul ;

vi) de jugement de l'existence ou non d'une section ne satisfaisant pas à une condition de perte de pression admissible (S10, S11) parmi toutes les sections du réseau de conduites de fluide qui ont été soumises au calcul en utilisant la méthode d'analyse des noeuds ;

vii) de modification du débit d'entrée/de sortie ou un dispositif de section (S13, S14) eu égard à la section ne satisfaisant pas à la condition de perte de pression admissible ;

viii) de calcul, à nouveau, des pressions aux points de branchement et aux parties de sortie eu égard du réseau de conduites de fluide en utilisant la méthode d'analyse des noeuds (S7) ;

ix) de jugement, à nouveau, de l'existence ou non d'une section ne satisfaisant pas à la condition de perte de pression admissible (S10), et

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x) de répétition de la modification du débit d'entrée/de sortie ou la modification du dispositif de section (S13, S14) et le calcul (S7) jusqu'à ce qu'il n'existe plus de section (S10, S15, S16) ne satisfaisant pas à la condition de perte de pression admissible.

- 5 **2.** Procédé selon la revendication 1, dans lequel les positions de noeuds et les positions de branchement entre les positions de noeuds sont affichées selon une forme de grille sur un écran d'un ordinateur personnel particulier.

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FIG.1

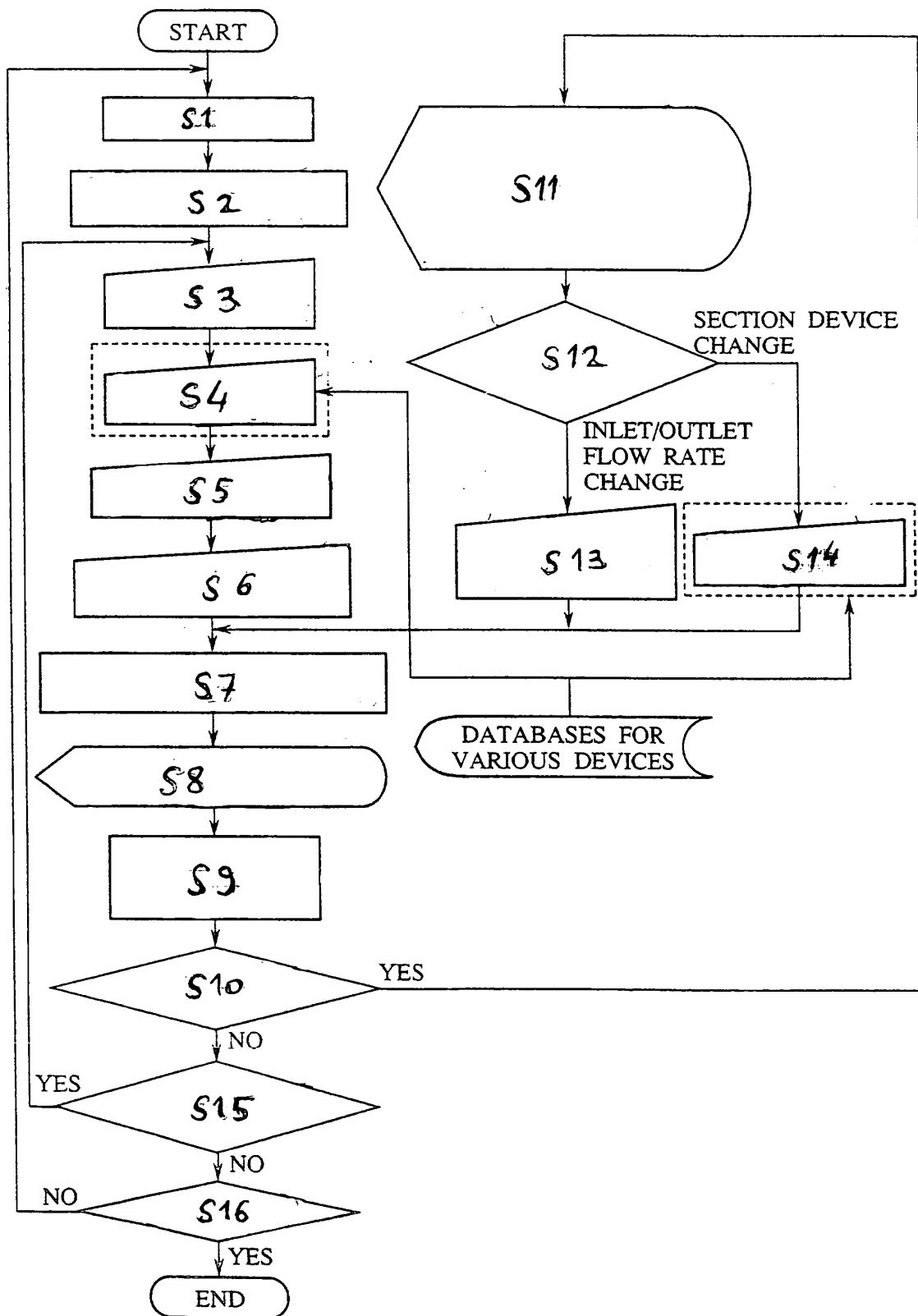
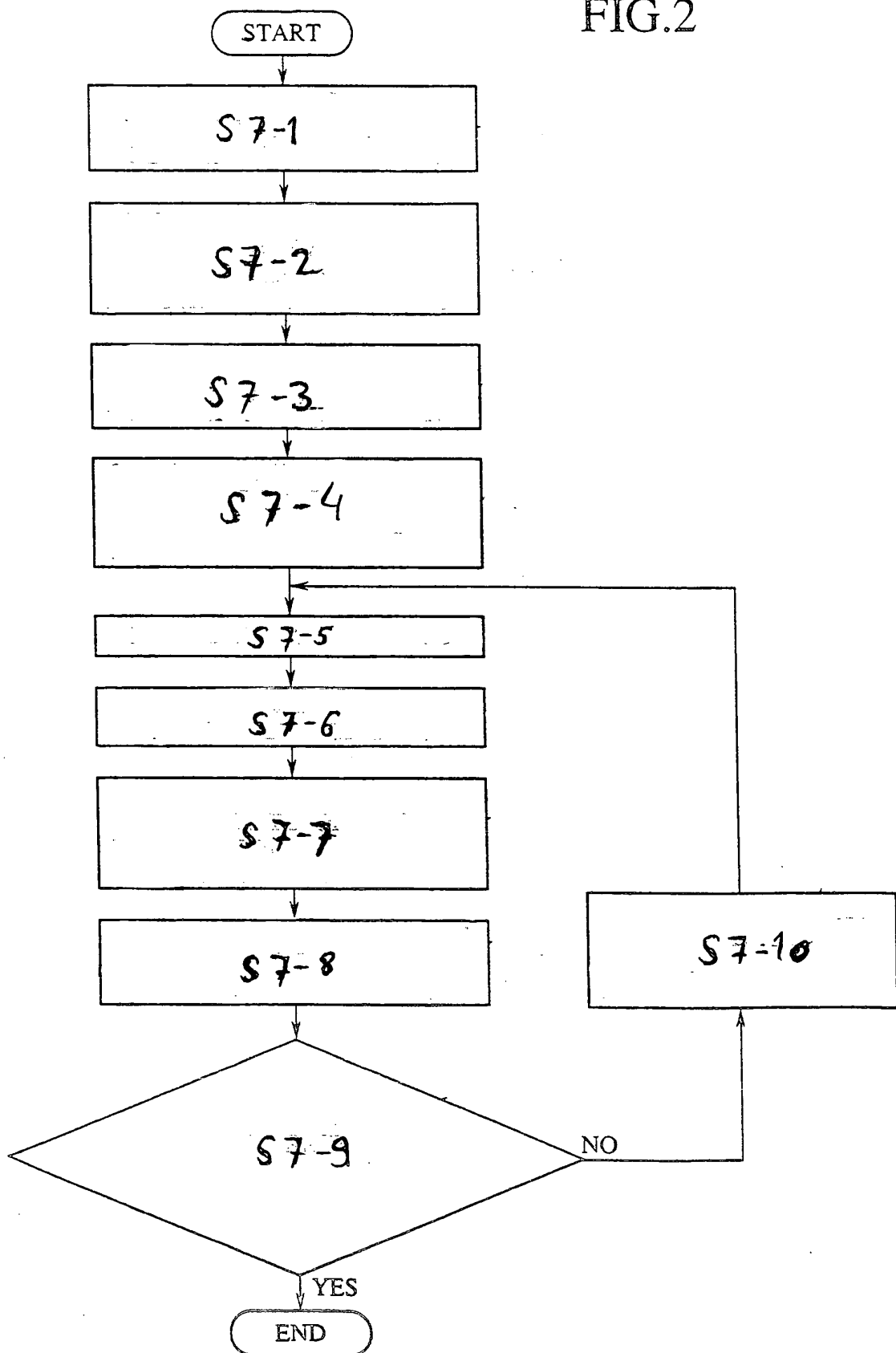


FIG.2



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